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Potential reciprocal effect between land use / land cover change and climate change

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Land use/land cover (LULC) activity influences climate change and one way to explore climate change is to analyse the change in LULC patterns. Modelling the Spatio-temporal pattern of LULC change requires the use of satellite remote sensing data and aerial photographs with different pre-processing steps. The aim of this research is to analyse the reciprocal effects of LUCC (Land Use and Cover Change) and the climate change on each other in the study area which covers part of Bristol, South Gloucestershire, Bath and Somerset in England for the period (1975-2015).

LUCC is assessed using remote sensing data. Three sets of remotely sensed data, LanSAT-1 Multispectral Scanner (MSS) data obtained in (1975 and 1976), LanSAT-5 Thematic Mapper (TM) data obtained in (1984 and 1997), and LandSAT-7 Enhanced Thematic Mapper Plus (ETM+) acquired in (2003 and 2015), with a time span of forty years were used in the study. One of the most common problems in the satellite images is the presence of cloud covers. In this study, the cloud cover problem is handled using a novel algorithm, which is capable of reducing the cloud coverage in the classified images significantly. This study also examines a suite of possible photogrammetry techniques applicable to detect the change in LULC. At the moment photogrammertic techniques are used to derive the ground truth for supervised classification from the high resolution aerial photos which were provided by Ordnance Survey (contract number: 240215) and global mapper for the years in (2001 and 2014). After obtaining the classified images almost free of clouds, accuracy assessment is implemented with the derived classified images using confusion matrix at some ground truth points.

Eight classes (Improved grassland, Built up areas and gardens, Arable and horticulture, Broad-leaved / mixed woodland, Coniferous woodland, Oceanic seas, Standing open water and reservoir, and Mountain; heath; bog) have been classified in the chosen study area.

Also, CORINE Land Cover (CLC) maps are used to study the environmental changes and to validate the obtained maps from remote sensing and photogrammetry data.

On climate change, different sources of climate data were used in this research. Three rainfall datasets from the Global Precipitation Climatology Centre (GPCC), the Climate Research Unit (CRU) and Gridded Estimates of daily Areal Rainfall (CEH-GEAR) in the study area were compared at a resolution of 0.5 degrees. The dataset were available for the operational period 1975-2015. The historically observed rainfall datasets for the study area were obtained from the Met Office Integrated Data Archive System (MIDAS) Land and Marine downloaded through the British Atmospheric Data Centre (BADC) website, which includes the rainfall and the temperature, are collected from all the weather stations in the UK in the last 40 years. Only four gauging stations were available to represent the spatial variability of rainfall within and around the study area. The monthly rainfall time series were evaluated against a dataset based on four rain gauges. These data are processed and analysed statistically to find the changes in climate of the study area in the last 40 years.

The potential reciprocal effect between the LULC change and the climate change is done by finding the correlation between LUCC and the variables Rainfall and Temperature. In addition, The Soil and Water Assessment Tool (SWAT) model is used to study the impact of LULC change on the water system and climate.